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CHAPTER 2

CRITERION VALIDITY OF AN ATTENTION- DEFICIT/HYPERACTIVITY DISORDER (ADHD) SCREENING LIST FOR SCREENING ADHD IN OLDER ADULTS AGED 60 – 94 YEARS

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CRITERION VALIDITY OF AN ATTENTION-DEFICIT/HYPERACTIVITY DISORDER (ADHD) SCREENING LIST FOR SCREENING ADHD IN OLDER ADULTS AGED 60 – 94 YEARS

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ABSTRACT

Objective: To identify Attention-Deficit/Hyperactivity Disorder (ADHD) in older adults, a validated screener is needed. This study evaluates the reliability and criterion validity of an ADHD screener for younger adults on its usefulness in a population-based sample of older adults.

Methods: Data were collected as a side study in the Longitudinal Aging Study Amsterdam. In a two-phase design the validity of the screener was tested against a structured diagnostic interview (DIVA 2.0). In Phase 1, 1494 respondents (60 – 94 years) were assessed with the ADHD screener. In Phase 2, 231 respondents participated in the diagnostic interview.

Results: Internal consistency (Cronbach's α) and reliability (ICC) of the screener were 0.71 and 0.56, respectively. The area under the curve was 0.82. The optimal cut-point was found at 2 (sensitivity: 0.80; specificity: 0.77; PPV: 0.13; NPV: 0.99).

Conclusion: Despite its low ICC, the ADHD screener may serve as a useful contribution to measure ADHD in the older population.

Introduction

Attention-Deficit/Hyperactivity Disorder (ADHD) in adults is often not well recognized. Although recent research shows that ADHD is a valid diagnosis in adults with lasting impairments from childhood into adulthood,^{1,2} problems arise when applying the currently recommended Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR) diagnostic criteria to older adults.⁵⁸ Firstly, these were developed for children aged 4 – 16 years and secondly, there are no age-appropriate symptoms and thresholds included in the DSM-IV-TR criteria.¹

ADHD is a chronic disorder, starting in childhood and often persisting into adulthood. It seems likely that ADHD persists into old age.⁵⁹ Thus far, there has been little systematic evidence to what extent this happens and whether it influences quality of life.

Because ADHD in older adults is a relatively newly recognized mental health disorder no screener for this population exists. Because full diagnostic work-ups for ADHD are only rarely carried out in geriatric psychiatry, a validated screener is highly relevant. Such an instrument would need to be valid, brief, and easy to use. Based on the Executive Functioning model,⁶⁰ Barkley and Murphy developed a short questionnaire to distinguish adults with ADHD from community control adults and adults with clinical disorders other than ADHD.¹ The authors created a list of the most common complaints considering verbal impulsiveness, working memory, sense and use of time, emotional self-regulation, and planning and forethought. In addition, they added items often mentioned by adults with ADHD in clinical practice. To reduce the item set, they selected the complaints occurring in at least 65% of the ADHD group and those that were significantly more present in the ADHD group compared with the control group. Logistic regression was used to further reduce the list to an adequate item set for ADHD in adulthood. The final set consists of seven executive functioning items and two DSM-IV-TR criteria.⁵⁸

Because this questionnaire was developed for young adults (mean age of 26 – 37 years), the present study examined the criterion validity of the questionnaire as a screener for detecting ADHD in older adults (aged ≥ 60 years). Furthermore, the test-retest reliability of the screener was determined. Finally, the optimal cut-off score for identifying ADHD in older adults was examined.

Methods

The study was part of the sixth cycle of the Longitudinal Aging Study Amsterdam (LASA), an on-going population-based study of the predictors and consequences of changes in

physical, cognitive, emotional, and social functioning of older people in the Netherlands. Procedures, sampling, and data collection have previously been described in detail.⁵⁵ In short, a random sample of older men and women, stratified by age and sex according to the expected 5-year mortality, was drawn from the population registries of eleven municipalities in three geographic areas of the Netherlands. Data collection started in 1992 – 1993, and included follow-up measurements every 3 years. Interviews were conducted in the homes of the respondents and consisted of a main interview and a medical interview in which tests were performed. Specially trained and intensively supervised interviewers conducted the interviews. Informed consent was obtained from all respondents, and the study was approved by the ethical review board of the VU University Medical Centre.

A two-phase design was used to validate the screening list. In Phase 1, the screening list was part of the regular medical interview. Data were collected of 1494 respondents of ages 60 to 101 years, 45 respondents were excluded at baseline due to greater than or equal to three missing values on the screener. For Phase 2, respondents were excluded when they showed cognitive decline (defined as a difference-score of more than one standard deviation (SD) on the Mini Mental State Examination (MMSE)⁵⁶ (≥ 3 points)) over the previous 3 years, low cognitive functioning (score ≤ 18), or a history of cerebrovascular accident. In Phase 2, 271 (18%) participants were selected based on their score on the screener. Scores were stratified into three levels: a high scoring group, most likely to have ADHD (score 3 – 9); a moderate scoring group (score 1 – 2) and the low scoring group (score 0). The participants from the low and moderate scoring groups were selected using a non-proportional stratified random sampling design. Ninety-four respondents of the low scoring group, 93 respondents of the moderate scoring group, and 84 respondents of the high scoring group were approached; 85 (90%), 80 (86%), and 69 (82.3%), respectively, consented to be interviewed. Three respondents were excluded from statistical analyses due to too many missing values (≥ 3), a cerebral vascular accident, or not being able to recollect childhood conditions. Thus, the study sample consisted in total of $N = 231$. Participants were on average 71.6 years old (SD: 7.70); 40.7% were men; mean MMSE score was 27.9 (SD: 1.82), where the total score on the MMSE ranges from 0 to 30, with higher scores indicating better cognitive functioning; mean score on the Center for Epidemiologic Studies Depressive Scale (CES-D) was 9.48 (SD: 8.43), where the total score of the CES-D ranges from 0 to 60, with higher scores indicating more depressive symptoms; and the mean number of chronic diseases was 2.10 (SD: 1.30).

Participants were visited by a trained and supervised interviewer for the ADHD assessment including both the screening list and the Diagnostic Interview for ADHD in Adults, second edition (DIVA 2.0).⁵⁷

Independent native speakers translated the ADHD screening list from the original English language into Dutch and back. The list consists of nine dichotomous questions about ADHD symptoms that occurred in the last 6 months. If participants responded with a positive answer to any of these, an additional item was asked whether these symptoms were already present in childhood. The sum score is based on the total number of symptoms ranging from 0 to 9, where higher scores indicate more ADHD symptoms.

The DIVA 2.0 is a semi-structured diagnostic interview for the assessment of ADHD in adults. It is based on the DSM-IV-TR criteria for ADHD and is widely used by mental health care professionals in the Netherlands and abroad (<http://www.divacenter.eu>).^{58,57} It assesses both current and childhood symptoms and impairment. With every DSM-IV-TR criterion, several examples are given to facilitate recognition. Respondents were classified as 'case' when they met the following criteria: at least four symptoms of either inattention and/or hyperactivity-impulsivity during the 6 months prior to the interview, and at least six symptoms of either inattention and/or hyperactivity-impulsivity in childhood (5 – 12 years of age).¹¹ Following the DSM-IV-TR criteria C and D, the respondents had to have clinically significant impairment in at least two areas of daily life (work, education, family, social & relationships, and self-confidence) during the past 6 months prior to the interview and in childhood.

Because we used a stratified selection, the study sample was weighted for each stratum for sampling probability. The weighting factor was calculated by the following formula: $1/(\text{observed } N/\text{expected } N)$.

Firstly, the internal consistency and test-retest reliability of the screener were calculated using Cronbach's α and the intraclass correlation coefficient (ICC 2.1-A). We considered a Cronbach's α of greater than or equal to 0.8 as good and a Cronbach's α between 0.8 and 0.6 as acceptable. An ICC of 0.75 or higher is considered to be an acceptable outcome when measuring stable characteristics. Secondly, the Receiver Operating Characteristics curve was calculated to evaluate the diagnostic performance of the screening list. The Area Under the Curve (AUC) shows the ability to correctly classify those with and without ADHD.

By dichotomizing the screener at various cut-points, sensitivity (true positives), specificity (true negatives), positive predictive value (PPV) and negative predictive value (NPV) were calculated at these cut-off points. Furthermore, we determined the optimal cut-off score, which was determined by calculating the highest sum of the sensitivity and specificity provided sensitivity greater than or equal to 0.80. Differences were considered significant if the p-value was less than 0.05.

Table 1 Cut-point analysis (sensitivity, specificity, PPV, NPV, and association with DIVA 2.0 Diagnosis) for total score on the screener

Cut-point	Sensitivity	Specificity	PPV	NPV
1	0.89	0.60	0.08	0.99
2	0.80	0.77	0.13	0.99
3	0.60	0.89	0.19	0.98
4	0.30	0.95	0.21	0.97
5	0.20	0.96	0.20	0.96
6	0.20	0.99	0.40	0.96
7	0.11	0.99	0.33	0.96
8	0.10	1.00	0.50	0.96
9	0.00	1.00	0	0.96

PPV = positive predicative value; NPV = Negative predicative value; DIVA 2.0 = association between the cut-point value and the DIVA 2.0 diagnosis (≥ 4 symptoms at present and ≥ 6 symptoms in childhood).

Results

Of the participants, 4.2% met the criteria for ADHD (male: 4.6%; female: 3.8%) using the diagnostic interview DIVA 2.0.⁵⁹

The internal consistency (Cronbach's α) of the screener in our sample was acceptable (0.71). Removing items from the screening list did not improve the internal consistency of the scale. The ICC was 0.56 (95% Confidence Interval: 0.47 – 0.65). The AUC of the screening list was 0.82.

Different cut-off scores were evaluated to investigate the properties of the screening list (Table 1). Because a good sensitivity and a low proportion of false negatives are more important in clinical settings than costs and a low proportion of false positives, we propose using the cut-off score of 2 as the optimal clinical cut-point in older adults (sensitivity: 0.80; specificity: 0.77; PPV: 0.13; NPV: 0.99).

Conclusion

The current study evaluated the criterion validity and basic psychometric properties of an ADHD screener developed for younger adults in its ability to detect ADHD in older adults. The best cut-off score for this population was determined. The screener showed an acceptable internal consistency (α : 0.71) and validity (AUC: 0.82) and had a moderate test-retest reliability (0.56). The optimal cut-point found was 2. Although ADHD is chronic and

persistent over time, the moderate test-retest reliability may be caused by slight variability in the self-perceived symptoms on the two measurements. Also, the way some of the questions were formulated may have led to misinterpretation (for instance, item 3: '*Often has difficulty stopping his or her activities or behaviour when he or she should do so*'). It could also be that the questions are not specific enough for older adults to recognize symptoms or that they experience other problems in daily life caused by ADHD.

Our study shows that it seems appropriate to use different cut-off scores for the older age group. The cut-point of 6 as proposed by Barkley and Murphy is based on symptoms of younger adults with ADHD.¹ This adjustment seems in line with studies that showed that when using the official DSM-IV-TR cut-points for diagnosing adults only 1% of the worst cases would meet the diagnosis.⁶⁰ The expression of symptoms may change over the lifetime, because of changing demands on the individual. Therefore age-referenced criteria and cut-offs have been proposed in the literature¹ and by the DSM-5 committee (<http://www.dsm5.org>). For the same reason it seems reasonable to adjust the cut-off score of the screener for the older age group.

Screening for ADHD in older adults comes with several limitations. Older-olds rate fewer childhood ADHD symptoms and also rate their memory worse than younger-olds.¹² Because the screener is based on self-report and childhood was, on average, 55 years ago, the recollection of the presence or absence of symptoms can be considered less than ideal. The childhood symptoms of ADHD may be both under-reported and over-reported by our older participants, although under-reporting is most likely. Both under- and over-reporting of childhood symptoms have a similar effect on the criterion validity of the screener. For instance, in case a participant did not report childhood symptoms of ADHD, which were in fact present, this would lead to no ADHD diagnosis as assessed with the DIVA 2.0. Given the presence of ADHD, our screener would have picked up current symptoms. This would lead to a (false) negative diagnosis in a screen-positive participant. The reverse applies in case a participant mistakenly reported childhood symptoms of ADHD when interviewed with the DIVA 2.0 leading to a false positive diagnosis. In this case the screener would not have picked up symptoms. This situation would have resulted in a participant who did have a DIVA 2.0 diagnosis but who screened negative. In both situations, the result is a lack of concordance between our diagnostic criterion instrument (the DIVA 2.0) and the screener, resulting in an underestimation of the criterion validity. A second limitation is that the diagnostic instrument used (DIVA 2.0) has not yet been validated. This could mean that the currently used DSM-IV-TR criteria on which the DIVA 2.0 is based are not subtle enough to detect ADHD in older adults. Third, we did not control for concurrent axis 1 and 2 disorders, while ADHD is associated with comorbidity. To our knowledge no other psychiatric or

physical disorder resembles the childhood onset and lifetime persistent course of the typical ADHD symptoms. Moreover, if the presence of comorbid disorders had any effect it would be a reduction in the criterion validity of the screener. Finally, when validating a screening list one might want to test its psychometric properties in a population of individuals with established diagnostic profiles of the disorder. At the time when our participants were young, however, the diagnosis of ADHD was not yet considered. It is therefore not possible to obtain such a study sample.

In conclusion, although screening for ADHD in older adults with this screening list has some limitations, it has also proven to show good sensitivity and PPV in a population-based sample of older adults. Therefore, we think the screener is a valuable instrument that warrants future study.